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A Review of Input and Output Policies for Cereals Production in Nepal

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Contents

List of Tables

List of Figures

List of Boxes

ABSTRACT

This study examines the existing status, policies, and institutions for promoting agricultural output in Nepal, in particular cereals. In this context, it reviews the policies on agricultural input such as seed, fertilizer, water, agricultural equipment, research and extension, and agricultural credit. It also provides an overview of the policies and programs related to agricultural output marketing and procurement of food grains in Nepal.

The analysis shows that although the overall GDPA growth has been on the positive side in recent years, there seems to be some amount of stagnation in the growth of key cereals—paddy, wheat, and maize. Except for maize, the production growth rates show a decline in this decade (2001 onward) compared to the previous decade. Paddy, which is by far the major crop in Nepal, as well as the main staple in the Nepalese diet, shows a decline in the growth rate of production from 2.9 percent in the 1990s to a 1.7 percent average annual growth rate post-2000/01. The overall cereal production growth rate also lags behind the population growth rate in Nepal. This is likely to exacerbate the cereal availability situation in the country and might have widespread impact on the food security status of households, especially in those regions of the country that suffer from poor infrastructural connectivity and a lack of market linkages.

The study also finds that availability and usage is at a very low level for most of the inputs in Nepal. Factors limiting the use of inputs for agriculture include those related to the socioeconomic conditions of agricultural holdings in Nepal, supply bottlenecks, policy gaps, and institutional constraints. Some of these factors are fairly universal, affecting utilization across most of the input sectors as well as affecting output marketing. These include limited capital and limited access to affordable credit by farmers, and a lack of transport and power infrastructure, which impedes input supply and domestic manufacturing.

On the output side, public intervention in cereal markets does not seem feasible due to infrastructure and resource constraints, which also restricts the government's capacity for affecting/regulating output prices. Here the optimal way forward for the government would be to focus on investments aimed at expanding and improving basic infrastructure—roads, power, communications.

Keywords: Nepal, cereals, input policy, output policy, food security

ACKNOWLEDMENTS

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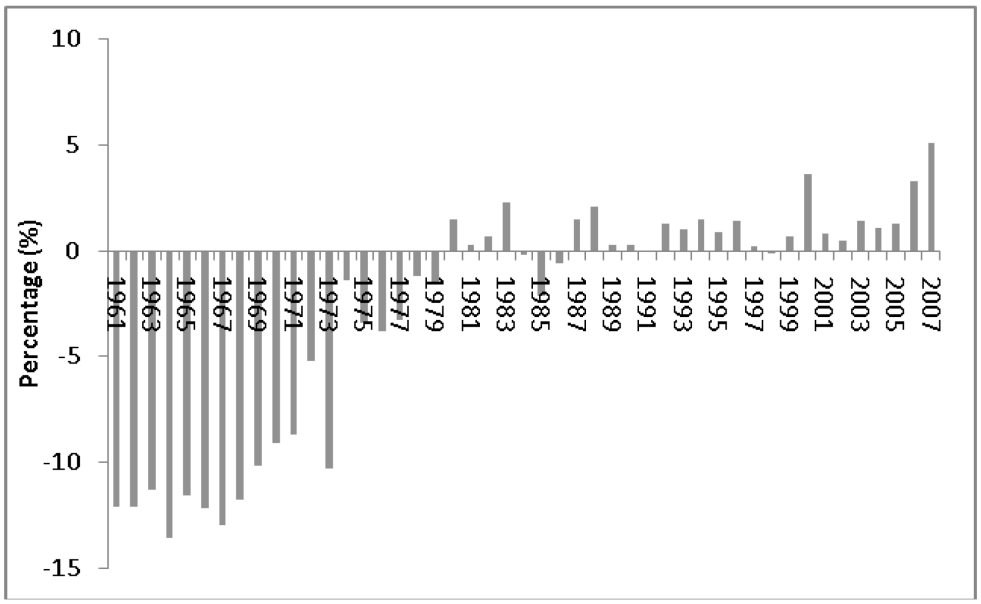
1. INTRODUCTION

The agriculture sector in Nepal dominates the economy, constituting more than 34 percent of the gross domestic product (GDP) (triennium ending [TE] 2008/09) and employing nearly 75 percent of Nepal's labor force (NRB 2010). Cereal crops are the mainstay of Nepal's agriculture, though their predominance has been showing some decline in recent years. The key cereals—paddy, maize, and wheat—occupy the major share of cropped area as well as the largest share (more than 37 percent in TE 2005 based on data from the Food and Agriculture Organization of the United Nations [FAO 2010]) in the value of output from agriculture. Cereals in Nepal are also crucial from a food security point of view. Cereals, especially rice, form the staple diet of the Nepalese population, providing nearly 69 percent of the total dietary energy supply and 63 percent of the total dietary protein supply in the period 2005–2007 (FAO 2010). The productivity level of cereals in Nepal is low, and growth has been sluggish in comparison to that in other countries in the region; cereal production has not kept pace with the growth in demand and population. Nepal, which was previously a net exporter of cereals, has, since around the 1980s, become a consistent net importer of cereals (Figure 1.1) as well as of other food items. The import dependence has been increasing in recent years and Nepal has also had to turn to food aid shipments in some years in order to meet the domestic food demand. Nepal's overall food trade deficit[1] reached 31 percent in 2007 (IFPRI 2010), and this food import bill is an additional strain on Nepal's low-growth economy. Various reports related to agriculture as well as food security assessments in Nepal have noted that low agricultural productivity is an important constraint on the achievement of national-level food security. They have highlighted the need to improve the supply of agricultural inputs and have called for better output infrastructure and food management policies in Nepal (ANZDEC 2002; GoN 2006; NPC and WFP 2010; Pokharel 2009).

Figure1.1—Net imports of cereals as a share of domestic production



Source: FAO 2010.

[1] Food trade deficit is defined as (food imports – food exports)/(food imports).

In this context, it is important to examine the existing status, policies, and institutional structures related to the various agricultural input sectors as well as with respect to output marketing and procurement of food grains. With this objective, this paper examines the key agriculture input sectors—seed, fertilizer, water, agricultural equipment, research and extension, and agricultural credit. It also provides an overview of the policies and programs related to agricultural output that are crucial for improving cereal production in Nepal.[2]

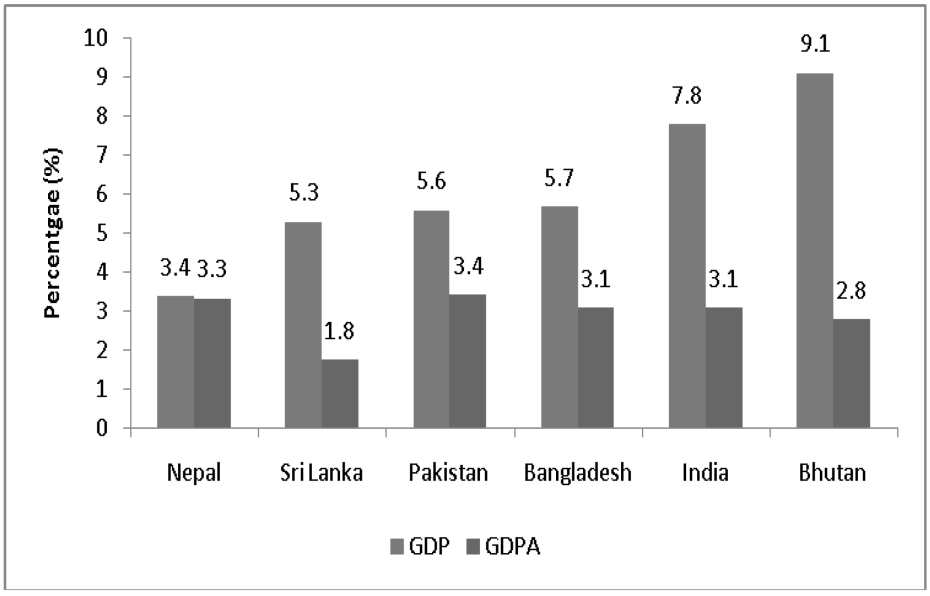
The paper first briefly examines the performance trends of key cereals in recent years in Nepal. The subsequent sections deal with the utilization status and the policy and programs related to each of the agricultural input sectors. This discussion is followed by a review of the output-side marketing policies and institutions in Nepal. The final section summarizes the key messages of the paper and explores possible areas and objectives that offer scope for partnership and cooperation between government, Cereal System Initiative South Asia (CSISA) partners, and other development partners.

[2] This review paper was undertaken as part of the Cereal System Initiative South Asia (CSISA) project. CSISA was started with the objective of providing an "overall strategy and a new umbrella for contributing new science and technologies to accelerating short- and long-term cereal production growth in South Asia's most important grain baskets" (CSISA 2010), with Nepal being one of the countries included in the project.

2. NEPAL AGRICULTURE AND CEREALS PERFORMANCE TRENDS

Nepal's GDP from agriculture (GDPA) has shown a relatively higher growth rate compared to its South Asian neighbors during the period 2001–07 (Figure 2.1). The overall economic growth rate in GDP per year lagged behind the other countries in South Asia, at 3.4 percent. Both GDP and GDPA in Nepal show high fluctuation. The coefficient of variation (CV) of the annual growth rate of GDP was 0.4, which was slightly lower than the CV for annual growth rate of GDPA, at 0.5 for the period 2001–09.

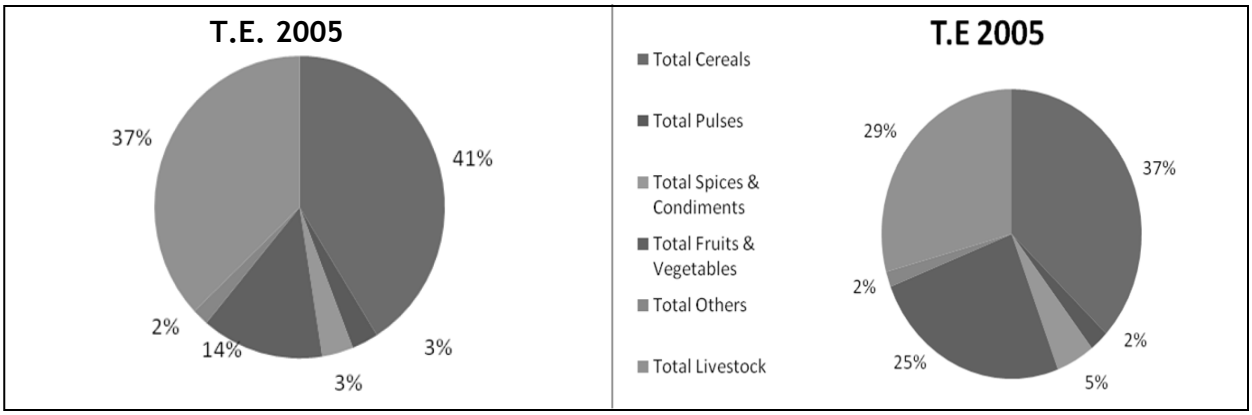
Figure 2.1—Gross domestic product (GDP) and gross domestic product from agriculture (GDPA): Average annual growth rates, 2000–07



Source: World Bank 2010.
Note: Arranged in increasing order of GDP growth.

The value of output of different subsectors of agriculture suggests a shift away from cereals and diversification toward high-value crops and products between TE 1981 and TE 2005 (Figure 2.2). The share of the high-value sector (comprising fruits and vegetables, spices and condiments, and livestock) rose from 54 percent to 59 percent between TE 1981 and TE 2005. More importantly, this increase did not come from the livestock sector, which showed steady growth of around 3 percent (IFPRI 2010) but whose share in the overall value of agricultural output did in fact decrease. The growth seems largely due to the rapid expansion of the fruits and vegetables sector. The share of fruits and vegetables jumped from 13.7 percent to nearly a quarter of the total value of agriculture (IFPRI 2010).

Figure 2.2—Value of output from agriculture and allied activities



Source: FAO 2010.
Note: TE = triennium ending.

The cereal share decreased from 41 percent to around 37 percent between TE 1981 and TE 2005 (IFPRI 2010), but cereals still make up the largest share of Nepal's agriculture in value terms. The area under cultivation is also dominated by cereals, with almost 75 percent of total cultivated area occupied by the five main cereals—paddy, maize, wheat, millet, and barley. Paddy, the most common crop, accounted for 35 percent of the total cultivated area and 46 percent of the cereal area in 2008/09 (IFPRI 2010; Nepal, MoAC 2009). In contrast, fruits and vegetables, which occupy only about 6.5 percent of the total cultivated area, contributed nearly a quarter of the overall value of agricultural output.

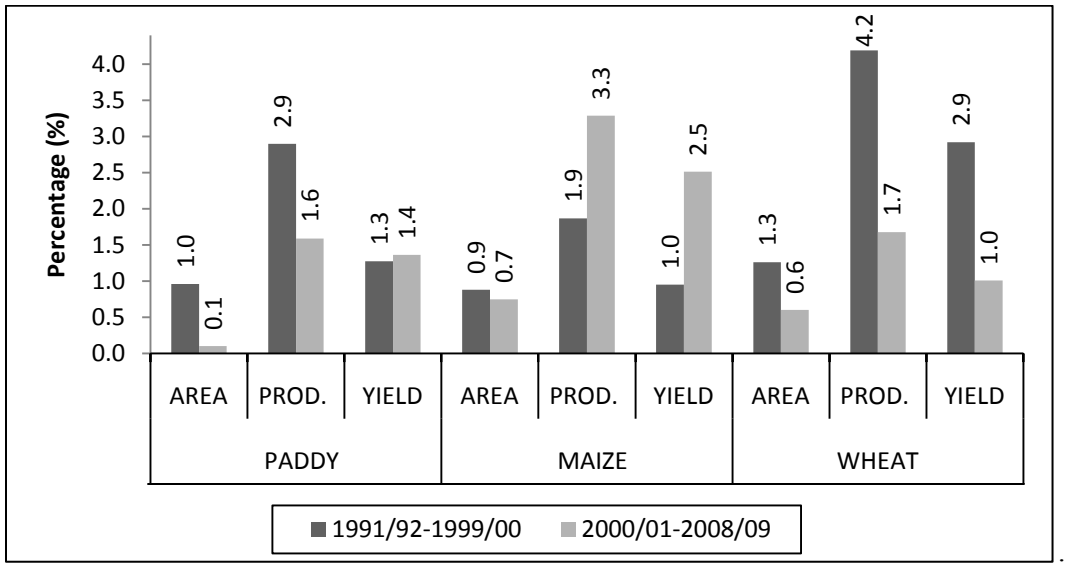
Cereal cultivation continues to remain crucial to Nepal's agricultural sector, and paddy by far is the most important crop—both in terms of area and production share among cereals. It is also important from a food security point of view, as it forms the major component of the staple Nepalese diet. Calories from rice form nearly 32 percent of the total daily per capita calorie supply and more than 24 percent of the protein supply quantity per capita per day (FAO 2010). The other key cereals forming a major part of the Nepalese agricultural sector in terms of their share in the cultivated area are maize (26 percent), wheat (21 percent), millet (8 percent), and barley (less than 1 percent).[3]

Paddy and wheat are mainly produced in the Terai region, with area shares of 70 percent and 57 percent, respectively, and production shares of 72 percent and 63 percent, respectively. Maize is predominantly cultivated in the Hill region, with this region having almost 70 percent of total area under maize as well as contributing a similar share of the total production of maize (Nepal, MoAC 2009). Yield levels of maize in the Hills region are, however, lower than in the Terai region (IFPRI 2010).

Overall cereal area barely grew—at a rate of 0.5 percent per year—in the period 2000/01 to 2008/09. Production growth rates were also low. Among the three major cereals (rice, maize, and wheat), maize has shown the fastest growth in the current decade compared to the earlier period (Figure 2.3). In fact, maize is the only cereal whose production growth rate (3.1 percent) exceeds Nepal's population growth rate of 2.1 percent (IFPRI 2010). The production growth in maize has been driven largely by yield enhancement, which shows a 2.4 percent rate of growth, rather than by an increase in area. This increase in yields of maize is largely attributed to the use of hybrid maize seed, which is sourced from across the open border from India. Officially, however, there is no hybrid variety of maize recognized by the Government of Nepal (GoN), and the entire hybrid maize seed trade is unofficial and unrecorded.[4] The GoN is currently in the process of approving some varieties of hybrid maize produced by private companies in India. Adoption of hybrid maize may have been driven by the rising demand for poultry feed in Nepal and demand for maize from the domestic poultry feed industry (IFPRI 2010).

[3] Share in total area under major cereals in TE 2008/09 (IFPRI 2010; Nepal, MoAC 2009).
[4] Based on discussions with local resource persons.

Figure 2.3—Area, yield, and production of major cereals: Average annual growth rates (%)



Source: Nepal, MoAC 2009.

Rice yield has shown only a marginal increase in the rate of growth in the recent period compared to the 1990s. The rate of growth in wheat yields, however, declined from 2.9 percent in the 1990s to about 1.0 percent during 2000/01–2008/09. Production growth rates of both paddy and wheat show a significant decline in the period 2000/01–2008/09 compared to the 1990s, which is an issue of concern.

3. INPUT SECTOR: STATUS AND POLICY ENVIRONMENT

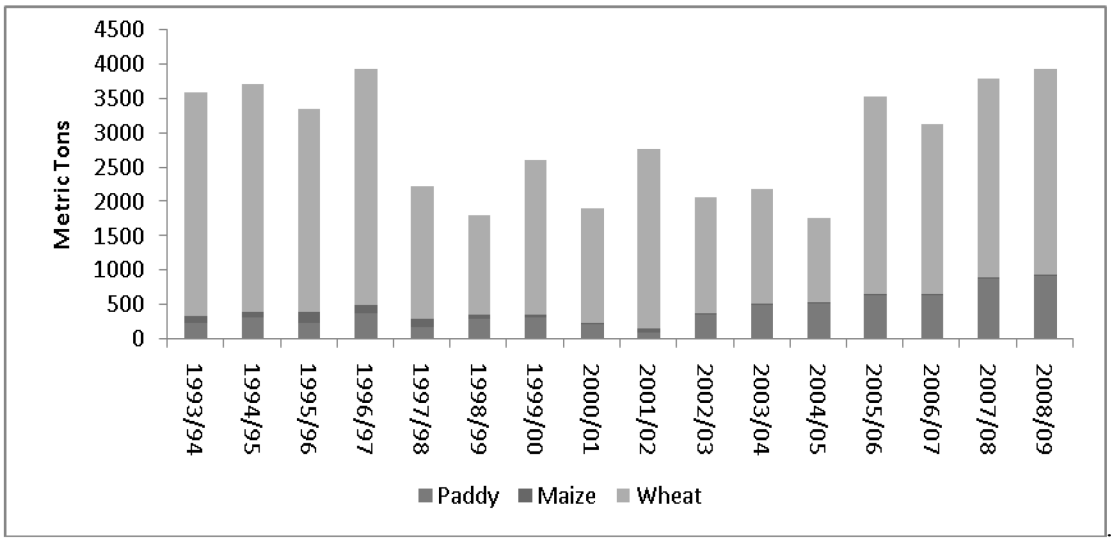
Seed Sector

Utilization and Status

The importance of irrigation and other inputs such as improved seeds in boosting productivity is well established, and the case in Nepal is no different. The yield differential figures for 2008/09 for cereals with irrigation and improved seeds underscore this point—in the Terai region, improved paddy seeds under irrigation resulted in yield levels of almost 3,500 kilograms per hectare, which was 41 percent higher than the yields resulting under unirrigated conditions with local seeds (IFPRI 2010).

However, use of improved seeds in Nepal is limited. The estimated use of improved seeds was around 5.4 percent for paddy and around 5.6 percent for wheat (Nepal, MoAC 2010). The supply of improved seeds itself is very low, with the total supply of improved seeds for cereals not even reaching 4,000 metric tons[5] per year in the entire period from 1993/94 to 2008/09 (Figure 3.1). The majority of the improved seed supply is made up of wheat seeds (more than 80 percent on average every year), with hardly any improved seed supply for maize. However, the growth in maize yields, as well as information from the field, seems to suggest that farmers in Nepal are using hybrid maize seeds in significant quantities, perhaps imported through unofficial channels from India. As most of this unofficial cross-border trade is not recorded in the official supply figures, these estimates of improved seeds most likely underestimate the actual situation on ground (IFPRI 2010).

Figure 3.1—Supply of improved seeds of major cereals (metric tons)



Source: Nepal, MoF 2009.

The seed sector in Nepal is handicapped by low domestic research and production capacity. As a result, the supply of breeder and foundation seed, which is required for further multiplication, is itself poor and the estimated shortfall is substantial. The total quantity of breeder and foundation seed production in 2009/10 was 31.7 tons and 429 tons, respectively, against requirements of 340 tons and 3,300 tons, respectively (Nepal, MoAC 2010).

[5] All mentions of tons in the text refer to metric tons.

Policies Governing the Seed Sector

The seed sector in Nepal is regulated under the Seed Act (1988) and the National Seed Policy (2000). The National Seed Policy (NSP) aims to ensure the availability of quality seeds in the required quantity for various crops and to ensure the conservation of indigenous genetic resources. The NSP also emphasizes varietal development, seed multiplication, quality control, promotion of the private sector in the seed sector, supply management, strengthening and capacity building of the organizations involved in the seed sector, and strengthening technology for improving seed sector development in Nepal. Table 3.1 presents an overview of policies and institutions pertaining to the seed sector in Nepal.

Table 3.1—Policies and institutional framework governing the seed sector in Nepal

Functional Area	Laws/Organizations	Main Features/Functions
Major laws and regulations related to the seed sector in Nepal	National Seed Act (1998) National Seed Policy (2000) Plant Protection Act (1972) Plant Protection Rules (1974)	• The principal national law on seed • Establishes a nodal agency governing all seed-related issues in Nepal • Governs introduction of germplasm and establishes rules governing international trade of seeds
Regulatory organizations	National Seed Board (NSB) NSB subcommittees: • Variety Approval, Release and Registration Subcommittee (VARRS) • Planning Formulation and Monitoring Subcommittee (PFMS) • Quality Standards Determination and Management Subcommittee (QSDMS) Seed Quality Control Centre (SQCC) National Plant Quarantine Programme (NPQP)	• Nodal agency to formulate and implement policies related to the seed sector • Subcommittees to undertake various functions Functions: • Monitoring the release, registration, promotion, and protection of released varieties • Planning, organizing production, supply, prescribing seed price, and so on • Recommending quality standards • Independent quality control organization under the Ministry of Agriculture and Cooperatives (MoAC) • Undertake seed testing, maintain testing standards, registration and updating of varieties of imported/exported seeds, monitoring and inspection to control seed quality
Research and extension	Nepal Agricultural Research Council (NARC) International Agricultural Research Centers (IRRI, CIMMYT, and others) Department of Agriculture (DoA) Donor-aided programs and nongovernmental organizations (NGOs) (Hill Maize Program, LI-BIRD, CEAPRED, and others)	• Apex public organization for agricultural research • Research, including the introduction of germplasm, research capacity building, and so on • Public extension organization with an organized network at the district level across the country • International and local NGOs involved in seed research, extension, and development
Seed supply	National Seed Company Ltd. (NSC) Private sector Informal seed supply system / farmer-to-farmer seed exchange	• Public seed company • Produce, procure, process, store, and sell seeds and also export/import • Currently there is no large private seed company, but there are 897 registered seed entrepreneurs/dealers • Ninety percent of seed demand is supplied by informal and on-farm sources

Source: Adapted from Shreshtha and Wulff 2007.

To further these objectives, a National Seed Board (NSB) was established under the Ministry of Agriculture and Cooperatives (MoAC) as the nodal agency to oversee policy and regulation of the seed sector in Nepal under the Seed Act. The NSB approves the seed varieties that are recognized for sale and distribution in Nepal and is also responsible for overseeing planning for the production and supply of quality seeds to meet the expected requirements. The NSB is responsible for maintaining the list of varieties that can legally be distributed or sold in the country. A variety must be officially approved and registered by the Variety Approval, Release and Registration Subcommittee (VARRS) of the NSB to be included in this list. A total of 213 varieties of 43 crops have been registered during 1960–2007 in Nepal, including 44 varieties of rice, 19 varieties of maize, and 28 varieties of wheat (NARC 2007b).
Any agency engaged in the import or export of these registered seed varieties must be registered with the Seed Quality Control Centre (SQCC) and on the National Plant Quarantine Programme (NPQP), both under the MoAC. Only seed varieties on the approved list can be imported legally into Nepal. However, this does not stop the informal trade in seed and crop varieties across the open border with India (Shreshtha and Wulff 2007).

Seed Research, Production, and Supply

The Nepal Agricultural Research Council (NARC) is the main agricultural research agency in the public sector in Nepal that is responsible for the supply of breeder and foundation seeds. NARC has an established network of regional stations and research farms and has been undertaking commodity-specific research for varietal improvement. Specific to cereals, NARC has been implementing the National Rice Research Programme (NRRP), the National Maize Research Programme (NMRP), and the National Wheat Research Programme (NWRP). It has been collaborating with international research agencies and the agricultural research institutes of neighboring countries on the exchange of germplasm and the development of improved varieties (NARC 2007a).

The International Rice Research Institute (IRRI) has been partnering with Nepal on various aspects of rice cultivation for more than 35 years, with the major focus being on germplasm exchange and capacity building. Out of nearly 54 rice varieties released in Nepal up to 2006/07, more than half have been developed using IRRI germplasm. IRRI continues to work closely with NARC through a memorandum of understanding for scientific and technical collaboration.

The International Maize and Wheat Improvement Center (CIMMYT), in long-standing collaboration with NARC, has worked on germplasm exchange and varietal improvement. CIMMYT has been involved in the Hill Maize Research Project (HMRP), which started in 1999 with support from the Swiss Agency for Development and Cooperation (SDC) and was extended to a fourth phase in 2010 under joint funding from SDC and the United States Agency for International Development (USAID). The HMRP has yielded 12 improved maize varieties for commercial production and led to the identification of numerous other promising lines. By 2009 NARC had developed more than 20 open-pollinated varieties and one hybrid in collaboration with CIMMYT (CIMMYT 2010).

For wheat, the Nepal-CIMMYT partnership has resulted in the release of a number of varieties—from the first Mexican semidwarf wheat variety in 1960 to more than 40 high-yielding wheat varieties in the years thereafter. The NWRP started by NARC in 1972 collaborated with CIMMYT from 1997 to 2008, a major outcome of which was the release of the first Ug99-resistant wheat variety (BL3063) in September 2010. Other long-term projects under this partnership include the Durable Rust Resistance in Wheat (DRRW) project, the USAID Famine Seed Project, and CSISA (CIMMYT 2010).

Prior to the 1990s, seed (and also fertilizer) supply and distribution in Nepal were undertaken by a state monopoly—Agricultural Inputs Company Ltd. (AICL)—at a subsidized rate through its own distribution network across the country. After the implementation of Nepal's Structural Adjustment Program and consequent liberalization, as a part of the overall reduction of the government's role and intervention in input markets, AICL was split into two different organizations handling fertilizers and seeds separately. After AICL was split, the seed supply wing was reorganized as National Seed Company Ltd. (NSC) in 2002.

NSC's objectives are to produce, procure (domestically as well as through imports), process, and sell seeds—from foundation seeds to improved varieties—on a commercial basis. It has about a thousand contracted seed growers in its seed production and multiplication program. In addition, it also produces source seeds for further production on its own farms, though the majority of source seed for multiplication comes from NARC or from the farms of international research stations. The procurement price of seeds is based on the prevailing prices for the respective grains, with seed growers being paid some premium as an incentive. NSC also undertakes processing, grading, and treating of the seeds received. In 2005/06 the company had 12 seed processing plants with a processing capacity of 17,900 tons per year and a storage capacity of 8,500 tons (Shreshtha and Wulff 2007). It is engaged in seed supply through its own distribution channel of depots and district offices. It also distributes seeds through a countrywide network of about 200 private contracted dealers (NSC 2006). NSC supplies seeds on an actual-cost basis (including procurement, processing, and marketing and distribution costs that are incurred).

By NSC's own reckoning, however, the quantity of seed produced and supplied is inadequate to meet the needs of Nepal's farmers (NSC 2006). The deficiency of the seed supplies in Nepal is highlighted in the accompanying report (Box 1) from a Nepal-based news media outlet that describes the significant shortfall that farmers experience in the availability and supply of improved seed, especially in the Hill and Mountain regions. A major bottleneck faced by NSC is with regard to the procurement of source seed for seed multiplication, for which it is mostly dependent on supply from NARC. In order to remedy this, NSC in recent years has been making efforts toward building its own in-house research capabilities.

The other major formal source of seed supplies in Nepal is the private sector. Although there are not many large-scale private seed companies in Nepal, there are 897 registered *seed entrepreneurs* who are mostly seed dealers and traders who also supply other agricultural inputs. They deal primarily with vegetable and flower seeds, while the cereal seed market is largely under NSC. These seed dealers and entrepreneurs are organized under the Seed Entrepreneurs' Association of Nepal (SEAN), which is an umbrella body representing the interests of the private seed sector, fostering cooperation among various players, and building partnerships to improve the production and supply of quality seeds in Nepal. However, the private seed sector in Nepal is at an early stage of development, and none of the companies have any own varietal development activities. Most of the seed dealers/entrepreneurs are engaged primarily in import and distribution of seeds from across the border (Shreshtha and Wulff 2007).

With domestic seed research and production limited, the import of quality seed is crucial for meeting the demand and for improving agricultural productivity. There have been a number of efforts to find local solutions to the seed inadequacy problem. For instance, the District Seed Production Programme (DISSPRO) implemented by the Department of Agriculture (DoA) involving private and cooperative growers, launched in 1996, seeks to address the issue of availability of seed by building local capacity for quality seed production through technical inputs from the district agricultural offices.

Various local nongovernmental organizations (NGOs) have been undertaking seed-related activities such as community seed multiplication, developing local seed banks, and improving seed distribution. Some of these NGOs include Local Initiatives for Biodiversity, Research and Development (LI-BIRD); Forum for Rural Welfare and Agricultural Reform for Development (FORWARD); Center for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED); New Era, and others.

Augmenting the seed sector in Nepal requires scaling up the existing public research and production facilities for improved seeds. There is a need to improve the linkages and expand cooperation between research activities undertaken by NARC and other agencies, as well as improving the production and distribution efforts of NSC. The success of the HMRP could hold lessons for similar efforts aimed at other cereals as well. However, one must also consider that Nepal's public seed sector capabilities are as yet limited, and it may not be possible for the public sector alone to generate the amount of investment required to successfully address the seed supply shortfall. A major deterrent to private-sector investment in this sector is the limited volumes of the domestic market and the higher costs involved in marketing

and distribution due to infrastructural constraints. One policy option for the government to consider in this regard would be to encourage private seed companies from India and other neighboring countries to increase their supply and to market and distribute their seed varieties in Nepal. Streamlining the certification, regulation, and quality inspection of imported seeds and easing the process of setting up local branches or subsidiaries of these private seed companies might help improve the seed supply situation. In any case, it appears that a significant volume of unofficial seed trade is already taking place from across the border. Routing this trade through official channels, while ensuring that additional transaction costs are kept to a minimum, could help ease the seed supply into the country. Regulation of this unofficial trade could also ensure quality and help maintain a uniform and better-distributed supply, instead of it being limited to the Terai region.

Box 1—News report on the status of improved seed supply in Nepal

Access to Improved Seeds Nominal in Hill Districts

KATHMANDU, June 16: Hill and mountain districts are still lacking access to improved seeds of cereal, despite efforts made by the government and private sector to boost their production and distribution.

Officials said: due to meager production of improved seeds and poor distribution network in the country, farmers are heavily dependent on traditional ways of producing seeds.

"Farmers of hill and mountain districts are using the same breeds for decades due to non-availability of improved seeds. We have found that seeds replacement rate in those areas is as low as four percent," said Dr Hari Dahal, spokesperson of the Ministry of Co-operatives (MoAC). ...

… Nepal needs 185,000 tons of seeds of paddy, wheat, maize, millet and barley every year. And most of the seeds are produced by farmers themselves.

National Seeds Company—a government-owned company—had produced only 3,809 tons of seeds last year, which is 2% of the national requirement. Hill and mountain districts, which cover more than 50 percent of the country's arable land, received only 13 percent of total seeds distributed by the company.

Nepal Agriculture Research Council and some private companies are producing and distributing seeds. However, there is no authentic data on the production of improved seeds across the country.

As per the production area, hill and mountain districts need 28 percent of total paddy seeds requirement of the country. However, currently, only seven percent of the country's total paddy seeds requirement reaches those areas. Similarly, in the case of wheat and maize seeds, only seven percent of the total requirement of the country reaches those areas.

Source: *Republica*, June 16, 2009, http://archives.myrepublica.com/portal/index.php?action=news_details&news_id=6400.
Note: This news item is printed from myrepublica.com – © Nepal Republic Media Pvt. Ltd., Kathmandu, Nepal.

Fertilizer Sector

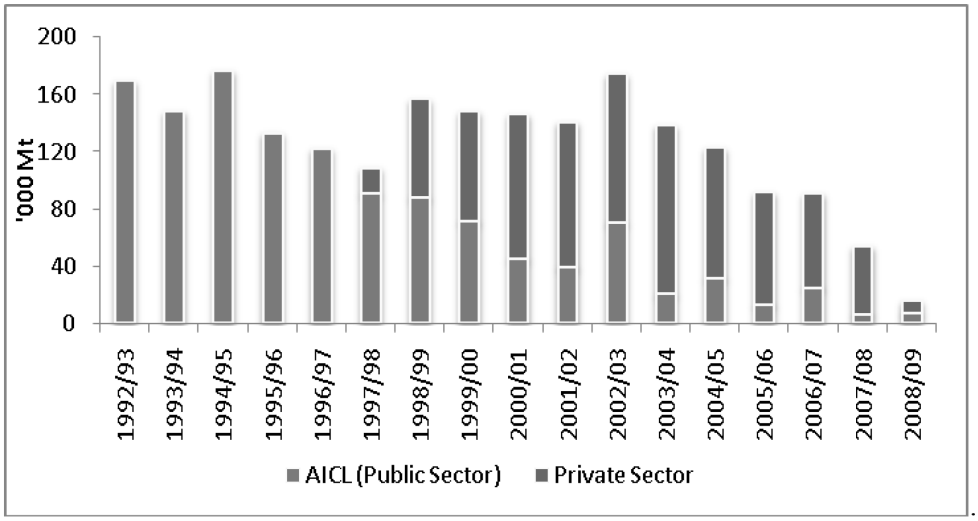
Utilization and Status

The level of chemical fertilizer usage in Nepal is one of the lowest in the region. Nepal's average fertilizer use of 19.1 kilograms per hectare in TE 2007 was higher than Bhutan's but much below the level of fertilizer use seen in the rest of the region (IFPRI 2010). Nepal's fertilizer use is only slightly above the average fertilizer use, of 15.6 kilograms per hectare, for the category of least-developed countries (FAO 2010). The supply of chemical fertilizer in Nepal is dependent completely on imports, as there is no domestic production facility available. As a result, Nepal's fertilizer supply and use are greatly affected by the trends in world prices.

The fertilizer supply (Figure 3.2) shows a steep decline in recent years—with supply declining from both government sources (AICL) and private-sector sources. This rapid decline in fertilizer supply in Nepal could have been a result of the sudden spike witnessed in worldwide fertilizer prices in the corresponding period (Figure 3.3). Here again, it should be mentioned that unofficial cross-border trade in fertilizer, which could be meeting a substantial portion of the fertilizer requirement in Nepal, especially in the Terai region close to the Indian border, is not captured in the official statistics. It was estimated that

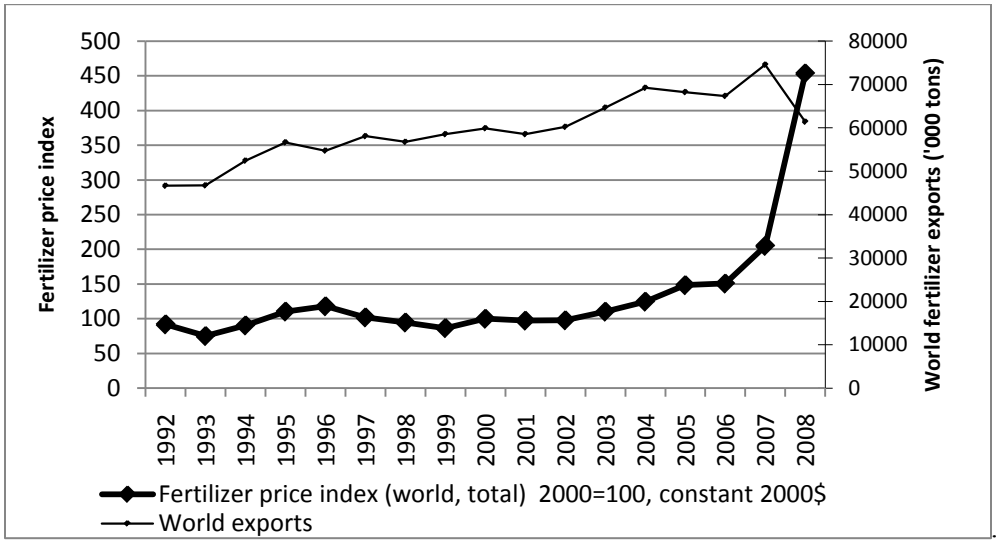
informal sources could have accounted for 60 percent of the total supply in 1997/98 and 80 percent in 2002/03 (WFP and FAO 2007)**.** Therefore, it is very likely that the actual intensity of fertilizer use in Nepal is underestimated when it is computed based on data for formal sources of supply alone.

Figure 3.2—Fertilizer supply in Nepal (‘000 metric tons)



Source: Nepal, MoF 2009.
Note: AICL = Agricultural Inputs Company Ltd.

Figure 3.3—World fertilizer price index and annual world fertilizer exports



Source: World Bank 2010 and IFA 2010.

According to the Nepal Living Standards Surveys (NLSS), the percentage of growers using fertilizers was highest among paddy farmers, at about 66 percent in 2003/04 during NLSS-II, as compared to 55 percent at the time of NLSS-I (CBS 2005). However, data on actual fertilizer consumption are not available except for estimates from two sample surveys carried out as a part of two studies in 2001 and 2002. The two surveys estimate a much higher level of fertilizer usage than what is estimated based on the official supply figures. The surveys’ estimates of fertilizer usage were 58 kilograms per hectare (ANZDEC 2002) and 56 kilograms per hectare (OPM 2003), respectively. The Oxford Policy

Management (OPM) study also shows that fertilizer use in the Terai region was more than four times higher than that in the Hill region. The main reason cited for higher fertilizer use in the Terai region was the ease of access to fertilizer due to proximity to the Indian border, and the consequent lower price of fertilizer (IDL Group 2006). No other comprehensive survey on fertilizer usage has been conducted since then.

Policies and Programs

Fertilizer trade in Nepal prior to 1997 was a state monopoly, with AICL being solely responsible for import and distribution of fertilizer and the cost of fertilizer being subsidized by the government. The liberalization of the fertilizer sector in 1997 resulted in a number of policy changes. These included the phasing out of price subsidies and transport subsidies,[6] the decontrolling of fertilizer prices, the inclusion of fertilizer imports under open general licensing (OGL), the removal of import duties and value added tax (VAT), the provision of foreign-exchange facilities to import fertilizers, the issuing of a new fertilizer policy and control orders to make fertilizer an essential commodity, the appointment of fertilizer inspectors to monitor the quality of supply, the upgrading of facilities for fertilizer testing, and other measures (Thapa 2006).

The broad objective of these policy and institutional reforms was to encourage private-sector participation in the formal fertilizer trade in Nepal, which would lead to an improvement in the fertilizer supply to meet domestic need (see Box 2 for salient features of fertilizer policies in Nepal). The total supply of fertilizer in the country did show some increase immediately following the policy reforms. The supply of fertilizer by AICL declined, but the private-sector fertilizer supply picked up—starting from 17,550 tons in 1997/98, the fertilizer supply by the private sector reached a maximum of 118,265 tons in 2003/04. Data on fertilizer prices are limited to the sale price of urea fixed by AICL. Two sharp spikes in urea prices are observed. The first was in 2000, when the price was hiked twice, amounting to a 45 percent jump over the previous year. The second spike observed is in 2007/08, when the urea price was hiked by 71 percent following a rise in the world price of fertilizers. The sharp rise in world prices has affected both public and private supply. For instance, private supply declined to 47,107 tons by 2007/08. The year 2008/09 proved to be the worst; the total supply was only 15,500 tons, and private-sector supplies hit rock bottom at only 8,132 tons. This demonstrates the need to find alternative solutions to ensure that the effects of such exogenous events on Nepalese agriculture are mitigated at least to some extent.

One should also recognize that although international prices might prove to be a factor hampering supplies, there are also domestic constraints to the smooth supply and distribution of fertilizer in Nepal. For instance, one of the factors behind lackluster private participation could be the ease of unofficial cross-border trade of subsidized fertilizer. This most likely reduces the demand for fertilizer from official supplies in the main fertilizer-consuming areas in the Terai region that enjoy a long, porous border with India. An additional problem is also the volume of trade—the private traders mostly undertake small volumes of transactions, which increases their unit cost of marketing and other fixed costs. Lack of transport infrastructure and the high costs of supplying and maintaining a distribution network and supply chain could also be disincentives for private fertilizer trade in the Hill and Mountain regions. Finally, the overall political instability may be discouraging the private sector from investing in the required infrastructure for maintaining supply chains across the country (IFPRI 2010).

As an emergency response to the huge shortfall in fertilizer supplies in 2008, the GoN reintroduced a subsidy scheme for fertilizers in order to tackle the problem of dwindling fertilizer supplies. Under this scheme, the sales price was fixed at 20–25 percent higher than that prevailing in India for five import points on the border, and AICL was appointed the sole agency to import fertilizer to be distributed at the subsidized rate through cooperatives. The retail price for farmers was the sales price at the import points plus the transportation cost involved, and AICL received the difference between the

[6] Transport subsidies were provided for fertilizer supply to inaccessible areas.

actual cost of import and the sales price at the import points (IFPRI 2010). The scheme aimed to supply 100,000 tons of fertilizer annually. However, the government has been unable to ensure timely supply of adequate quantities of fertilizer. While there are no data on the associated costs of fertilizer supply by the private and public sectors and the price differential between them, it has been reported that private traders have found it difficult to compete with the subsidized rates and that this has led to a worsening of the situation (Shrestha 2010).

Box 2—Salient features OF fertilizer policies in Nepal

FERTILIZER CONTROL ORDER (1999)

Objective: To ensure the quality of fertilizer supplied to farmers

Main features:

- Any legally registered private business firm allowed to enter the fertilizer business
- Provision of fertilizer inspectors for quality checks
- Quality control mechanism during import
- Quality control at the retail level

NATIONAL FERTILIZER POLICY (2002)

Objectives:

- Provision of conditions (policy and infrastructure management) to enhance fertilizer usage
- Promotion of an integrated plant nutrient management system (IPNS) for the efficient and balanced use of fertilizers

Main features:

- Broad definition of fertilizer to include three types of fertilizer: organic, chemical, and microbial
- Equal treatment of government, private, and cooperative firms involved in the fertilizer business
- Elimination of the price subsidy but continuation of the transport subsidy for selected districts of the high hills and mid hills
- Provision of buffer stock to respond to the acute shortage of fertilizer during the main cropping season
- Policy of encouraging domestic production of fertilizer and investing in the fertilizer industries of neighboring countries

Source: Nepal, MoAC 2010 and Shrestha 2010.

The usefulness of the subsidization policy has also been questioned in some quarters when the rates of application are very low. In this context, there have been suggestions that government intervention through fertilizer subsidy be limited to inaccessible areas, while leaving market forces to resolve the supply problem in the accessible areas (IFPRI 2010). If Nepal were to follow a fertilizer subsidy policy similar to that followed by the Indian government, the cost of such a subsidy has been estimated at Nepali Rs. 3.1 billion annually (Thapa 2006), which would be a substantial burden on the Nepali economy. Building domestic fertilizer production capacity also seems unviable due to the absence of a domestic source of raw materials or feedstocks, the high energy costs in Nepal, and the small size of the domestic market for fertilizers. Considering these constraints, Nepal must continue to depend upon imports for fertilizer supply. To smooth the supply in a volatile world market, the government could explore the possibility of entering into joint ventures with public- or private-sector entities in neighboring countries for the establishment of fertilizer production facilities in those countries, with a supply guarantee agreement that could help ensure that a minimum amount of fertilizer supply was ensured every year. In addition, the distribution mechanism within the country needs improvement, especially when it comes to ensuring supplies to the Hill and Mountain regions. Developing demand-side strategies such as efficient soil-nutrient conservation techniques and solutions based on on-farm or locally available resources that could provide alternatives to chemical fertilizers may help reduce the overall requirements and help ease import dependence.

Irrigation Sector

Utilization and Status

Nepal's water resource potential is very high, considering that it possesses 2.27 percent of the world's water resources (Bhattarai and Goutam 2003). The annual runoff from all rivers is estimated to be more than 220 billion cubic meters, and groundwater resources are estimated to be around 12 billion cubic meters. Water use for domestic and agriculture needs is estimated to be 13.8 billion cubic meters, and expected demand by 2027 is 38.8 billion cubic meters (IFPRI 2010).

In spite of the relative abundance of water resources—both surface and groundwater—the extent of irrigation provision in Nepal is rather limited. Total irrigated area in Nepal in 2008/09 was reported to be 989,230 hectares, or 32 percent of the total cultivated area (Nepal, MoAC 2009). Overall irrigated area under crops in Nepal has been showing a gradual upward trend, with an annual average growth of 1.9 percent in the period 2000/01 to 2008/09 (Nepal, MoAC 2009). This is, however, a much slower rate of increase than the average growth rate of 4.6 percent reported over the period 1995/96 to 1999/2000 (ANZDEC 2002). In the 1990s, less than 30 percent of Nepal's cultivated area was actually irrigated, and this percentage varied from 38 percent in the Terai region to less than 18 percent in the Mountain region (NENCID 1999). The total irrigable area itself was low in the Mountain and Hill regions, but the level of utilization of the irrigation developed was higher in the Mountain and Hill regions (66.7 percent and 56.5 percent, respectively). In contrast, the Terai region, which would be expected to lead in terms of irrigation development and utilization, actually showed poor levels of utilization, with less than 39 percent of the irrigable area actually under irrigation (IFPRI 2010).

The irrigation statistics for 2005/06 (Table 3.2) of the Department of Irrigation (DoI) do indicate an increase in the cultivable command area (CCA) in the Terai region, with the CCA rising to 58.5 percent of total irrigable area. The Mountain and Hill regions also show an increase. More detailed data, if available, could help experts analyze whether the increase is due to groundwater-based or surface-water-based extension of irrigation and formulate a strategy for the future accordingly (IFPRI 2010).

Table 3.2—Status of irrigation development, 2005/06

Ecological Region	Mountain	Hill	Terai	Total
Total irrigable area ('000 ha)	60	369	1,338	1,766
Irrigation development status (ha)	50	182	995	1,227
(as % of total irrigable area)	(83.8%)	(49.5%)	(74.4%)	(69.5%)
Cultivable command crea (ha)	25	118	783	926
(as % of total irrigable area)	(41.8%)	(32.1%)	(58.5%)	(52.4%)

Source: Nepal, DoI 2007.

Policies and Programs

The Ministry of Irrigation (MoI) is the chief nodal agency overseeing matters related to water resources and irrigation in Nepal, including the preparation of plans and policies governing the harnessing and utilization of water resources, as well as matters of regional cooperation and partnering with bilateral and multilateral donor agencies for irrigation development in Nepal. Structurally, the MoI's functions are split across two departments—the Department of Irrigation (DoI), which primarily deals with all issues of implementation related to irrigation sector development in the country, and the Department of Water Induced Disaster Management, which is concerned with mitigating the widespread impacts of water-induced natural disasters in Nepal. The DoI has as its mandate the functions of planning, developing, maintaining, operating, managing, and monitoring different modes of irrigation and drainage systems in Nepal. The MoI and DoI function within a framework of policies and acts that govern the water resources

and irrigation sector in Nepal. Box 3 presents a brief overview of the key policies related to water and irrigation management in Nepal.

The Agriculture Perspective Plan (APP) (APROSC and JMA 1995), which has been the main long-term perspective plan for boosting agriculture in Nepal, stressed irrigation as one of the priority input areas (IFPRI 2010). Technically, all of the Terai region could be irrigated by large surface-water schemes, but the capital-intensive nature of these projects, the socioeconomic constraints, and issues related to cross-country water-sharing rights pose a challenge (ANZDEC 2002). On the groundwater front, the resource potential is also high; the groundwater aquifers underlying the Terai region are some of the "most productive aquifers on the sub-continent" (ANZDEC 2002). Considering the relative ease and lower cost of tapping this resource, both the APP and subsequent irrigation planning in Nepal under the five-year plans emphasized developing groundwater irrigation, with a special focus on shallow tube wells (STWs) and in some areas on extension of deep tube wells (DTWs).

Box 3—Salient features of water and irrigation policies in Nepal

WATER RESOURCE ACT (1992)

Objectives:

- To promote the rational utilization, conservation, management, and development of water resources
- To make legal arrangements for determining beneficial uses of water resources
- To prevent environmental and other hazardous effects of pollution on water resources

Main features:

- Defines and provides the legal basis for water user associations
- Defines the priority order for utilization of water resources—according the highest priority to drinking water, followed by water for irrigation and other agricultural purposes, and then for other uses such as hydro-electricity, industries, and so on

WATER RESOURCES STRATEGY (2002) and IRRIGATION POLICY (2003)

Objectives:

- To provide year-round irrigation facilities to irrigation-suitable land by effective utilization of the current water resources of the country
- To develop the institutional capability of water users for the sustainable management of existing systems and to enhance the knowledge, skill, and institutional working capability of technical human resources, water users, and nongovernmental associations/organizations relating to the development of the irrigation sector

Main features:

- Emphasis on the principles of integrated water resources management (IWRM) in project formulation
- Policy of involving the private sector in construction, operation, and management of the irrigation system
- Existing and newly developed irrigation systems to be transferred to the users, including the possession and ownership of the land and other infrastructure belonging to the transferred system

NATIONAL WATER PLAN (2005)

Objective:

- To provide comprehensive operational guidelines to achieve the output objectives of earlier policies and strategies, specifically the Water Resource Strategy

Main features:

- Further emphasis on IWRM and river basin management (RBM)
- Programs addressing security aspects (disaster management, environmental protection, and so on) and water use for various sectors
- Guidelines for organizational and institutional structures and mechanisms governing water resources
- Framework for decentralization, and priorities for resource utilization and regional cooperation
- Detailed investment analysis for optimal development of water resources in Nepal

Source: Water Resources Act 1992 and Nepal, MoI 2003,2005.

By 2002 an estimated 50,000 STWs were operating in the Terai region (ANZDEC 2002). To meet the targets set under the APP, the GoN initially provided a subsidy for STWs (ranging from 30 percent to 60 percent of the capital cost) and DTWs (up to 84 percent of the capital cost). However, following the removal of these subsidies under the conditions of the Second Agricultural Program Loan, progress under the STW program slowed, and against the APP target of 90,000 hectares to be added under new groundwater schemes by the end of the period 1997/98–2001/02, the target achieved was only

29,374 hectares. By the year 2005/06, as per the figures available from the DoI, the number of STWs was 67,705 and the number of DTWs was 711 (Nepal, DoI 2007). It is important to analyze the factors limiting the spread of groundwater irrigation in Nepal, especially in the Terai region. If it is only a lack of investment capability among farmers that is preventing the spread of groundwater irrigation, then it is necessary to find ways to extend incentives such as affordable credit as well as to find innovative, low-cost alternate solutions for groundwater irrigation expansion.

Although the extension of irrigation based on groundwater is certainly a viable strategy with possibly quick returns and lower capital constraints, from the point of view of securing long-term irrigation and tapping hydropower resources, as well as stabilizing water flows as a means of flood control, harnessing the surface-water resources in Nepal also needs to be seen as an important strategy. Until the 1980s the focus of government efforts in Nepal was on the creation of medium and large surface-storage irrigation systems. However, a number of challenges limit the extent to which this resource can be tapped for sustainable use in Nepal. Seasonal variations in flows are high, with 82 percent of annual river flows occurring from June to November. Eighty percent of the annual mean precipitation of 1,530 millimeters is received during the summer monsoon period from June to September. Also, sedimentation in rivers in Nepal is high, with the total sediment load per year estimated to be equivalent to 1 millimeter of top soil being washed away (Water and Energy Commission Secretariat 2002). This poses certain technical challenges to the development of large surface-storage structures for harnessing the water potential of Nepal. Additional challenges are posed by the currently limited understanding of the fragile ecohydrology of the Himalayas and the possible impacts of factors such as climate change.

Another crucial aspect to be considered with respect to harnessing surface water in Nepal is the issue of regional cross-country collaboration and water sharing. Regional and subregional cooperation in developing this rich potential resource is crucial for meeting the water and power needs of Nepal and its co-riparian countries, as well as for flood control in the downstream areas of rivers originating in the Himalayas. This requires collaboration on technical aspects (in order to better understand the hydrogeology of the Himalayan watershed), investment in the required infrastructure, and also regional negotiations to arrive at suitable water- and power-sharing arrangements between countries.

Smaller surface-water irrigation systems have been traditionally used in Nepal, especially in the Hill and Mountain regions. These have also had a long history of being under community-based management (Regmi 2008). Numerous studies have in fact observed that the farmer-managed irrigation systems (FMIS) in Nepal performed relatively better than those systems that were agency managed (Lam 1998), and the popularity of the FMIS can be gauged by the fact that in 2005/06 more than 67 percent of the surface-water-irrigated area was operating in the FMIS mode (Nepal, DoI 2007).

Beginning around 1985, the emphasis gradually shifted from the creation of irrigation systems to better utilization of existing irrigation infrastructure, and government policies and programs leaned toward increasing the participation of users in the management of irrigation. Various policy reforms within the government, starting with the Water Resources Act of 1992 and leading up to the new Irrigation Policy in 2003, also saw a definite policy shift toward encouraging a more participatory approach—recognizing the legal rights of water user associations (WUAs), laying down guidelines for the transfer of irrigation project management from the DoI to WUAs, and so on (Regmi 2008). The changes in the institutional aspects of the irrigation sector continued with the enactment of the Local Self Governance Act (LSGA) in 1999, which handed over the management of local resources at the district level to the District Development Councils (DDCs).

This period also witnessed a number of donor-aided programs whose focus was on management development and promoting user participation in the administration of irrigation schemes. Some of these donor-aided programs included the Irrigation Management Project, started in 1985 (funded by USAID); the World Bank–supported Irrigation Line of Credit (1988); the Irrigation Sector Project, financed by the Asian Development Bank (ADB) (1988); and the Irrigation Sector Support Project (ISSP), started in 1989 and jointly supported by the United Nations Development Programme (UNDP), the World Bank, and ADB.

However, the performance of FMIS is not uniform across districts, and not every FMIS is successful. Earlier studies have identified design issues as well as unfavorable resource conditions that hinder efficient performance of FMIS (Ostrom 2002). They have also underscored that there is a "strong institutional aspect to irrigation systems" that needs to be strengthened to improve FMIS performance (Regmi 2008). To address this issue, the DoI is implementing the Community Managed Irrigated Agriculture Sector Project (CMIASP) with funding from ADB and the Organization of Petroleum Exporting Countries (OPEC), which focuses on improving FMIS across 35 districts. The World Bank–supported Irrigation and Water Resources Management Project also aims to strengthen the irrigation infrastructure as well as help build institutional capacity for efficient management.

Farm Mechanization and Agricultural Equipment in Nepal

Utilization and Status

The use of agricultural machinery and modern technology for farm operations in Nepal has been acknowledged to be at a very low level (CBS 2006). Human and animal labor is the dominant source of farm power, with the large majority of farm households lacking even basic modern farm implements. For instance, the Agricultural Census (2001/02), which was the last comprehensive assessment of farm mechanization in Nepal, notes that only 26.1 percent of farm households reported using the most basic farm technology—the iron plow. Use of more advanced agricultural technology, though showing an upward trend from 1991/92 to 2001/02, was still limited. Around 8.2 percent of holdings reported using tractors, 7.5 percent of total holdings reported using a thresher, and only 6.3 percent of holdings in 2001/02 reported using a pump set (Table 3.3). Interestingly, while the absolute number of pieces of equipment showed an increase from 1991/92 to 2001/02, the proportion of ownership among holdings using this equipment showed a decrease. Nevertheless, it appears that access and availability to modern agricultural technology did improve (CBS 2006).

Table 3.3—Use of agricultural equipment in Nepal

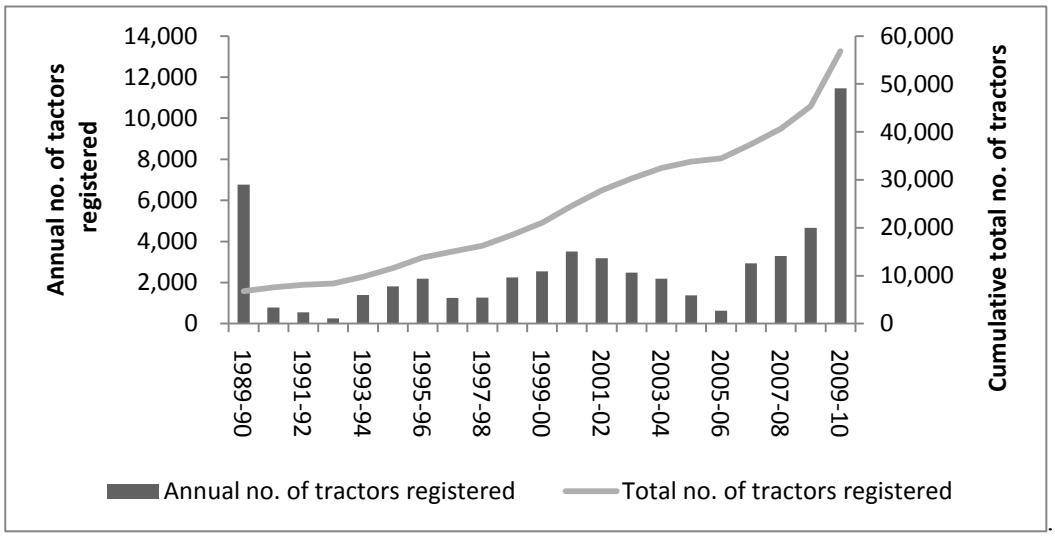
Type of equipment	1991/92			2001/02			Growth in % of households using equipment*	% growth in number of items**
	Holdings using equipment		Number of items ('000)	Holdings using equipment		Number of items ('000)		
	No. ('000)	% of total		No. ('000)	% of total			
Total land holdings	2,703.9	100	…	3,337.4	100	…	-	-
Iron plow	315.1	11.7	354.5	870.3	26.1	890.2	1.44	15.1
Power tiller	5.6	0.2	1.6	15.6	0.5	11.8	0.03	63.8
Shallow tube well	50.9	1.9	48.2	119.7	3.6	109.5	0.17	12.7
Deep tube well	20.1	0.7	15.7	58.6	1.8	51.5	0.11	22.8
Rower pump	3.5	0.1	3.8	22.7	0.7	21.8	0.06	47.4
Tractor	35.2	1.3	5.5	272.9	8.2	150.6	0.69	263.8
Thresher	85.6	3.2	19.9	249.5	7.5	129.1	0.43	54.9
Pumping set	81.3	3	41.3	210.4	6.3	146.1	0.33	25.4
Animal-drawn cart	204.6	7.6	198.1	226.4	6.8	199.1	-0.08	0.1
Sprayer	50.2	1.9	23.4	203	6.1	145.9	0.42	52.4
Other	296.5	11	878.4	449	13.5	1,072.7	0.25	2.2

Source: CBS 2006.
Note: * percentage point increase per year; ** average increase in number of items per year.

Since 2001/02, although there has been no nationwide assessment of the status of farm machinery usage and technology adoption, a few studies looking at the level of farm mechanization have opined that farm mechanization is on an upward trend in Nepal, especially in the Terai region (Manandhar 2005; Adhikary 2007). Farmers have been adopting mechanically powered machines for power-intensive farm operations such as tillage, transport, threshing, and lift irrigation, but not so much for farm operations in which the degree of control required is higher (for example, operations such as transplanting, weeding, harvesting, and so on). One of the factors cited as driving technology adoption has been the crunch in agricultural labor due to the extensive out-migration from rural areas witnessed in recent years.

Although there is not much data to confirm this trend, one indicator that certainly seems to support this view is the increase in the number of tractors in Nepal, data for which are available from the vehicle registration database of the Department of Transport Management. Although it is not clear how many of the tractors that are being added annually are used for agricultural purposes, the number certainly shows an increase. The total number of tractors registered was just short of 60,000 by 2009/10, which is more than 2.3 times the number existing in 2000/01. Tractor registrations show an increase from 2006 onward, coinciding with the end of the internal unrest in Nepal (Figure 3.4). If this is any indication of an increase in private investment in agriculture in Nepal, it would augur well for the health of the sector.

Figure 3.4—Number of tractors registered in Nepal (annual and cumulative total)



Source: Nepal, DoTM 2010.

Policies and Programs

Though there are some signs of an increase in farm mechanization and the use of agricultural technology, Nepal has a long way to go in terms of bringing up the adoption rate and extending the use of technology substantially across the country. Some of the challenges that may be hindering the adoption of technology and farm mechanization in Nepal include the large share of smallholders and a general lack of investment, compounded by a lack of access to affordable credit and other socioeconomic constraints. Constraints on the technological front include poor technology and the low capacity of blacksmiths and other rural artisans traditionally involved in farm implement manufacturing, a lack of farm technologies appropriate for smallholders, the poor network of agricultural machinery traders, and a lack of spare parts and maintenance facilities. The lack of rural electrification and power supply also serves as a constraint to the adoption of certain types of on-farm and off-farm agricultural equipment such as electrical pumps, modern threshers, milling plants, and so on. Also, as the out-migration of males leads to an increased

feminization of agricultural, there will be a need for the design, manufacture, and supply of farm implements that are suited for use by women too.

Farm mechanization and technology is recognized as an important component for enhancing agricultural performance in the National Agricultural Policy (NAP) of 2004, as well as under the developmental plans of the government; however, there has been no separate policy addressing this issue in particular. Researchers and commentators, even from within the government, have pointed out the need for a clear-cut policy for agricultural technology and related matters (Manandhar 2009). The lack of such a policy has been detrimental in a number of ways—for instance, in the lack of technical and safety standards for various types of farm machinery and the lack of recognition, guidelines, and incentives for local agricultural machinery manufacturers and for enterprises engaged in agricultural equipment rentals.

The spread of farm mechanization and the adoption of agricultural machinery in Nepal have also been handicapped by limited resources in domestic manufacturing facilities—both public and private—as well as constraints on the institutional front, especially with regard to research and extension. The Agricultural Engineering Division (AED) of NARC[7] is the main public agency concerned with research and development of farm machinery and technology, while the dissemination and extension activities are the responsibility of the Department of Agriculture (DoA). Some commentators have pointed out the lack of agricultural engineering programs, deficiency of trained manpower, and lack of investment in facilities for research and testing laboratories and workshops in the AED and have bemoaned the absence of agricultural technology specialists and the lack of technology-specific extension activities within the public extension system at the district level. As a result, technology dissemination so far has been limited to sprayers and metal bins for storage (Manandhar 2009). Also missing are institutional facilities for testing, quality control, and standardization of agricultural machinery manufactured in Nepal or imported.

Government-led efforts to increase farm mechanization appear to have been limited, and it is not clear whether there are any programs targeting small farmers. Numerous donor and civil-society efforts have been aimed at developing, promoting, and distributing pro-poor and sustainable farm technologies. Some of these technologies and programs are highlighted in Box 4.

Box 4—Farm-mechanization-related programs and technologies promoted in Nepal

- RESOURCE-CONSERVATION TECHNOLOGIES (RCTs) for wheat and rice: International research centers such as the International Rice Research Institute (IRRI) and the International Center for Maize and Wheat Improvement (CIMMYT), in collaboration with the Nepal Agricultural Research Council (NARC), have been testing and adapting various RCTs for Nepalese conditions, of which zero/minimum tillage by power tiller drill has proved to be fairly popular among farmers.
- LOW-COST IRRIGATION – Treadle pumps and low-cost drip irrigation systems pioneered by International Development Enterprises/Nepal (IDE/Nepal) have also been successful in some of the Terai areas.
- RENEWABLE ENERGY TECHNOLOGIES – Improved water mills (IWMs), biogas plants, and micro-hydel plants have been successfully promoted through public–private partnerships in Nepal. Though not directly related to on-farm mechanization, these technologies are important in meeting rural energy needs, and the models used for promotion of these technologies can also be successfully adapted for the promotion of farm technology.
- A few other commodity-specific technologies developed by the Agricultural Engineering Division (AED), NARC, and some civil-society organizations have been successfully commercialized. These include a hand maize sheller, a coffee pulper, a millet thresher cum pearler, low-cost solar dryers, and others. These successful examples may hold appropriate lessons for the development and commercialization of other farm technologies.

Source: Manandhar 2005, 2009.

[7] AED was established in 1953 under the then Ministry of Agriculture. Later, AED was shifted under the auspices of NARC after its establishment in 1991.

Agricultural Support Services: Agricultural Research, Extension, and Credit

Agricultural Research

As mentioned above, the Nepal Agricultural Research Council (NARC) is the principal agency undertaking research in agriculture. Some other agencies, such as the Nepal Academy of Science and Technology (NAST), the National Agricultural and Research and Development Fund (NARDF), academia (principally the Institute of Agriculture and Animal Science—IAAS), and some NGOs, are also engaged in undertaking or sponsoring agricultural research, but their role is relatively small. NARC conducts research programs either itself or in collaboration with regional and international institutions (for instance, as previously mentioned, NARC has had a long-running partnership with IRRI and CIMMYT).

Several issues confront the country's agricultural research system. For one thing, it has been widely commented that the system is not dynamic enough in responding to the emerging needs of farmers and entrepreneurs operating in an increasingly competitive environment. A Department of International Development (DFID)-funded Review of Research Impact, Responsiveness and Future Priorities carried out in 2005 (ITAD – New Era 2005) found that rice varieties developed by NARC did not generate much impact in terms of yield gains. Research on maize and wheat has met with better success. Introduction of new maize varieties has led to maize being grown in the spring and winter, along with the traditional summer maize, and wheat productivity growth has showed an upward swing since the early 1990s. In the case of both of these crops, NARC's active role has been facilitated through its long-standing association with CIMMYT (ITAD 2005). Impressive progress has also been achieved in the case of vegetables—mainly off-season vegetables (Chapagain 2010). However, research impacts have not been seen to such an extent with respect to improved breeds of livestock.

Adequate staffing has also been an issue at NARC. In 2006, NARC had a total of 406 slots for scientists and an additional 306 slots for technical support staff. Only 61 percent of these slots were filled, and the remaining 39 percent were vacant. Forty-five percent of the positions for scientists were unfilled. NARC's share in the total national budget declined from 0.58 percent in 2001/02 to 0.21 in 2008/09. Similarly, its share in the MoAC budget dropped from 14.7 percent to 8.8 percent over the same period (Nepal, MoF 2009).

Agricultural Extension

Since the beginning of institutionalized agriculture extension in Nepal in 1952, the structure, organization, and extension models and approach used have undergone frequent changes. After its establishment in 1952, the Department of Agriculture was split into five departments in 1966: the Department of Agriculture Extension, the Department of Fishery, the Department of Horticulture, the Department of Livestock Health, and the Department of Agricultural Education and Research. Then in 1972, these departments were merged back into one as the Department of Agriculture, as it was felt that there was a lack of effective coordination between the five departments. After seven years, in 1979, two departments—the Department of Agriculture and the Department of Livestock Development and Animal Health—were created to focus on crop and livestock extension services. In 1991, the department went through another round of reorganization, with all extension services being brought under one organization as the Department of Agricultural Development; this was followed in 1995 by reorganization back into two departments—the Department of Agriculture and the Department of Livestock Services. In 2000 it went through one more round of restructuring; 9 program directorates were established under the Department of Agriculture, which were later expanded to 12 program directorates and 14 national programs in 2004. Despite these repeated restructurings of the extension services, there do not appear to be any efforts to introduce new models of extension.

Currently the extension activities are carried out through DoA and Department of Livestock Services (DLS) district offices in all 75 districts of the country. Each district office operates through a network of four to five service centers, each of which covers two to four village development committees

(VDCs). Extension coverage includes issues related to crop cultivation practices as well as livestock and animal health issues. The workload of extension workers, as indicated in Table 3.4, certainly appears overly heavy, especially considering the country's difficult terrain, physiographic situation, limited transport facilities, and physical infrastructure (Chapagain 2010).

Table 3.4—Extension coverage of DoA and DLS

Items	DoA		DLS	
	2007	2001	2007	2001
VDC per JT, JTA	2.54	2.15	2.70	2.47
Households per JT, JTA	3,204	2,713	3,417	2,893
Cropped area (ha) per JT, JTA	2,606	2,166	NA	NA
Livestock units per JT, JTA	NA	NA	7,161	6,177

Source: Chapagain 2010.
Note: DoA = Department of Agriculture; DLS = Department of Livestock Services; JT = junior technician; JTA = junior technical assistant; VDC = village development committee.

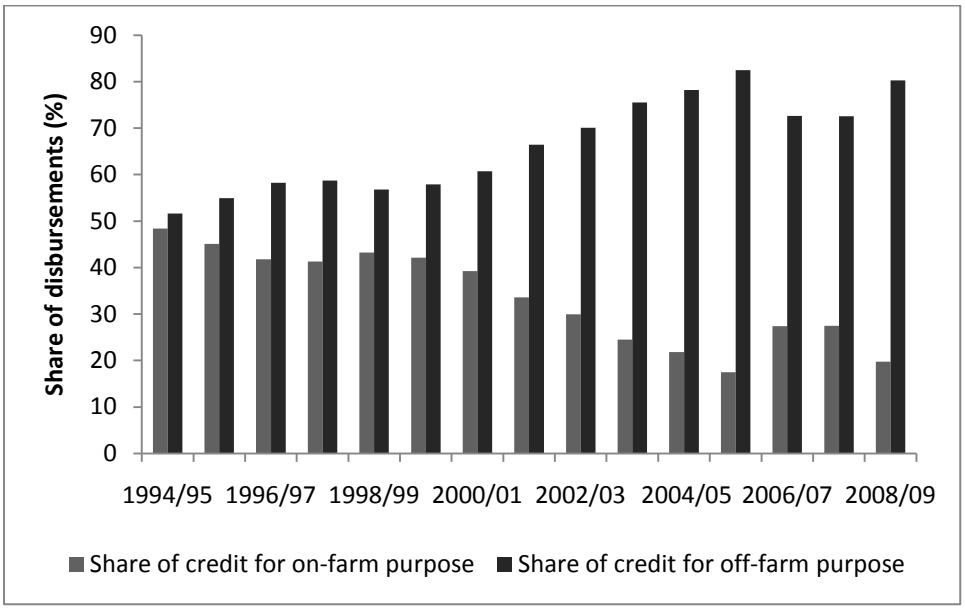
Some of the gaps in extension coverage have been addressed by private voluntary organizations providing extension services. However, scant information is available on the extension models that are currently being followed by these organizations in Nepal and their effectiveness. Also, it is possible that important lessons can be drawn from some of the studies undertaken on agricultural extension models elsewhere that might also be applicable in the Nepali context.

Agricultural Credit

The major formal financial institution for agricultural credit in Nepal is the Agricultural Development Bank Ltd. (ADBL). In addition, Nepal has seen rapid growth in the number of savings and credit cooperatives. These cooperatives have a three-tier structure, with village-level cooperatives forming district unions, which belong to a national-level federation of savings and credit cooperatives unions.

An increasing share of ADBL's credit to agriculture is toward off-farm purposes such as agro-industries, marketing, and godowns (Figure 3.5). This might be an indication of increasing investment in value addition in agriculture, but a more detailed study would be required to assess whether this has resulted in substantial inroads toward the commercialization of agriculture. However, ADBL's share of credit disbursement for on-farm purposes such as agricultural tools and irrigation shows a decline, though the volume of credit (in nominal terms) does show an average annual growth of almost 5 percent from 2000/01 to 2007/08 (Nepal, MoAC 2009).

Figure 3.5—Credit disbursements by the Agricultural Development Bank Ltd. (ADBL): Share of credit for on-farm versus off-farm purposes



Source: Nepal, MoAC 2009.

This trend might also be a reflection of the restructuring and recent changes that have been undertaken in the ADBL. After the enactment of the Bank and Financial Institution Ordinance (BAFIO) in February 2004, all acts related to financial institutions in Nepal, including the Agricultural Development Bank of Nepal (ADBN) Act, 1967, were abolished. Consequently, in line with the BAFIO, ADBL was incorporated as a public limited company in 2005. Following this, ADBL underwent a process of restructuring, with the divestment of government shares in ADBL and an increased emphasis on commercial banking operations. Some observers are of the view that this move might have led to a reduction in ADBL's role in providing rural credit, especially for agriculture, an issue that merits deeper analysis.

The findings of a 2006 Access to Financial Services Survey by the World Bank (Ferrari, Jaffrin, and Shrestha 2007) indicate that the use of banks for financial services in Nepal is limited. The survey found that financial NGOs and cooperatives are playing a larger role in providing both deposit accounts and loans, and that overall informal borrowing far exceeds formal borrowing in Nepal. The survey reports that only 26 percent of Nepalese households had a bank account, and that about 38 percent of Nepalese households with an outstanding loan had a loan exclusively from the informal sector, 16 percent had loans from both the informal and formal sectors, and only 15 percent of households were found to have loans exclusively from the formal sector.

Even more significantly, the survey reports that financial access, as measured by the number of bank deposit and loan accounts per 1,000 people, was decreasing. The number of deposit accounts per 1,000 people had dropped from 113 in 2001 to 90 in 2005, and the number of loan accounts per 1,000 people fell from 19 to 10 during this period.

It is important to note that this was the trend despite the exponential growth that Nepal had witnessed in the number of formal financial institutions during this period. In 1980 there were only 4 licensed financial institutions. By 2005 Nepal had 180. These included 17 commercial banks, 25 development banks, and 59 finance companies, along with four microfinance development banks, five regional rural development banks, 20 financial cooperatives, and 47 financial intermediary NGOs in the regulated microfinance sector (Ferrari, Jaffrin, and Shrestha 2007).

While the number of institutions mushroomed, their financial status remained weak. In 2005 commercial banks (public and private) had an average capital adequacy ratio of –6.3 percent and nonperforming loans of 19 percent. Banks in the private sector performed better than public ones, but they also exhibited weaknesses. In 2005 the average capital adequacy ratio for private commercial banks was 11.4 percent, and nonperforming loans averaged 5.3 percent. The financial status of the institutions in the nonbank financial sector was also not very strong (Ferrari, Jaffrin, and Shrestha 2007). The issue of credit, especially for agriculture, is without doubt crucial.

The situation in Nepal suggests that along with measures at the ground level aimed at achieving greater reach and penetration, it is also important to pay attention to stabilizing and regulating the overall financial health of financial institutions.

4. OUTPUT MARKETS: POLICIES AND INSTITUTIONAL STRUCTURE

The previous sections presented a brief picture of the changing structure and performance trends in Nepal's agriculture and an overview of the input scene. Due to the lack of any substantial value chain studies in the existing literature on Nepal, there are major knowledge gaps pertaining to the current storage and postharvest infrastructure and processing practices and problems that could be affecting supply chains. This section builds on the limited information available and attempts to provide an overview of the policies and institutional structure of the cereal output market in Nepal.

Before looking at the output scene, it would be pertinent to recall a few important characteristics of Nepal's agriculture that have a bearing on output market policies and the institutional structure. First, the majority of Nepal's agricultural sector is characterized by smallholders. In addition, the productivity, as seen in yield levels, is low for most crops. As a result, marketable surplus for most farms is limited or even absent. Estimates of the share of output marketed, based on sample surveys, suggest very low percentages: 21 percent for paddy, 26 percent for wheat, 34 percent for potatoes, and 43 percent for vegetables (CBS 2005).[8] The marketing system and infrastructure must accommodate these small volumes of surpluses spread over a large number of producers whose average farm sizes are small. The role of aggregators at the village/district level is important and would from a key link in the farmer-to-consumer chain. These aggregation activities could be carried out by private agents, cooperatives, or government agencies, depending on contextual factors (IFPRI 2010).

Second, the important contextual factors in Nepal's case that could affect agricultural marketing are (a) the constraints to physical accessibility posed by the terrain as well as underdeveloped road and transport infrastructure and (b) both official and unofficial agricultural produce trade across the open border with India, which may affect the competitiveness of domestically produced commodities due to the subsidies provided by India to its agriculture and government-administered minimum support prices in India for rice and wheat. Variations in these effects across Nepal may necessitate strategies that are tailored to suit local and regional conditions (IFPRI 2010). The marketing strategies and activities of the various agencies involved must take into account these specific characteristics, and government policy and the regulatory framework must be geared toward addressing these needs.

Government Agriculture Marketing Regulations, Pricing, and Procurement Policies in Nepal

Traditionally, government policy and interventions in agriculture markets in Nepal were motivated by the need to ensure adequate food grain supply through output procurement as well as the need to bridge market gaps on the agricultural input side. Since the majority of Nepalese farmers were involved in cereal cultivation, government efforts were largely concentrated around cereals.

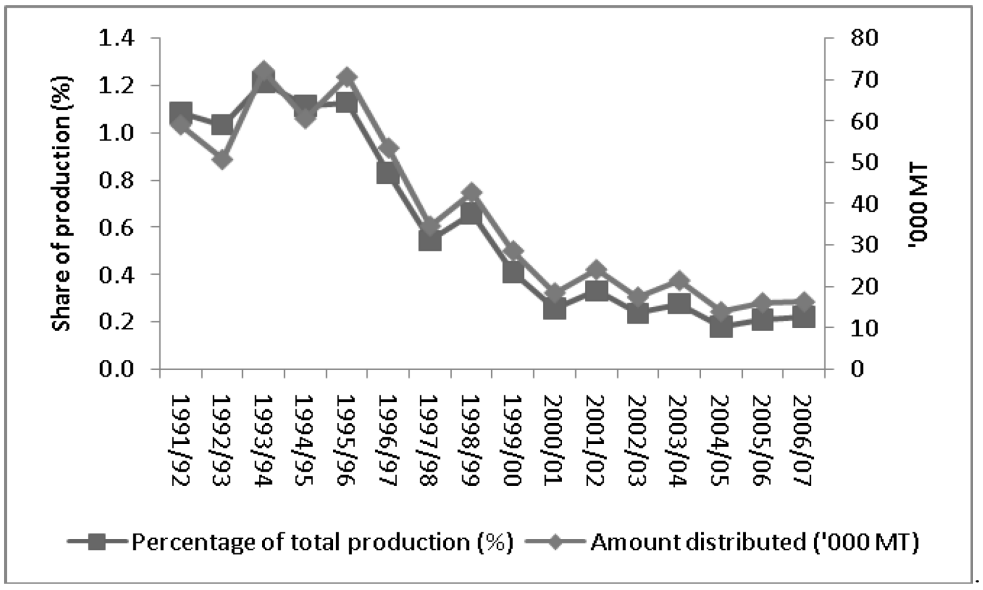
The Agriculture Marketing Corporation (AMC) was set up in 1971/72 to manage both input and output distribution. It was established after the need for a national-level agency to monitor and undertake procurement and supply of agricultural inputs and outputs was felt following droughts and excess rains, especially in the Hills region and remote areas, that affected agricultural production as well as food grain supply (Pyakuryal, Roy, and Thapa 2010).

The twin objectives of the AMC were to stabilize food prices and increase agricultural production by providing incentives to producers. By 1974 the AMC was split into the Agricultural Input Corporation, which dealt with input sourcing and distribution, and the National Food Corporation (NFC), which undertook procurement and distribution of food grains. The NFC procured food grains at a fixed price, which was usually determined taking into account the minimum support price (MSP) that was announced for procurement by the Indian government. Following the government's liberalization measures in the mid-1990s, the NFC's role was reduced, and operations on both the procurement and the food grain supply fronts were cut back (IFPRI 2010).

[8] Data for more recent years were unavailable.

NFC procurement of wheat and paddy at MSP was finally discontinued during the Tenth Plan (2002–2007), and since then it has procured food grains at market prices, usually from traders and open markets. It uses its own procurement, along with food aid received from international agencies, to supply around 30 districts that have no road connectivity (IFPRI 2010). Its share in the grain trade has, however, been minimal, with less than 1 percent of total production of principal crops (if the marketable surplus is about 25 percent, this share would amount to around 4 percent) being procured through its operations during the mid-1990s and continuing to fall in recent years (Figure 4.1). It has also been noted that after procurement from farmers at MSP was discontinued and after NFC turned to procurement from open markets to meet its needs, there was a decline in food procurement quantity, which led to a decline in stocks and godown capacity utilization (Pyakuryal, Roy, and Thapa 2010). With respect to laws governing agriculture and agriculture marketing, Nepal has extensive laws, regulations, orders, and so on pertaining directly to various aspects of the issue (IFPRI 2010). However, it was also observed that overall there is "neither a policy to ensure that producers and traders compete freely nor to prohibit connivance and cartels in the domestic market" (WFP and FAO 2007).

Figure 4.1—Food grain distribution by the National Food Corporation (NFC)



Source: NTWG 2007.

Currently, the main government body responsible for policy and regulation of agricultural marketing in Nepal is the Agribusiness Promotion and Marketing Development Directorate (ABP & MDD), housed within the MoAC. It is responsible for marketing infrastructure, formulating market rules and directives, and suggesting price policy formulations for agricultural commodities, and it is also entrusted with the responsibility of export promotion. The ABP & MDD has under its wing the government market yards, of which there are nine wholesale markets, 30 collection centers, and 1,056 local *haat.*[9] The individual market management is entrusted to the Agricultural Produce Market Management Committee (APMMC), which is made up of elected representatives of the traders, producers, and other stakeholders availing of the market facilities (IFPRI 2010).

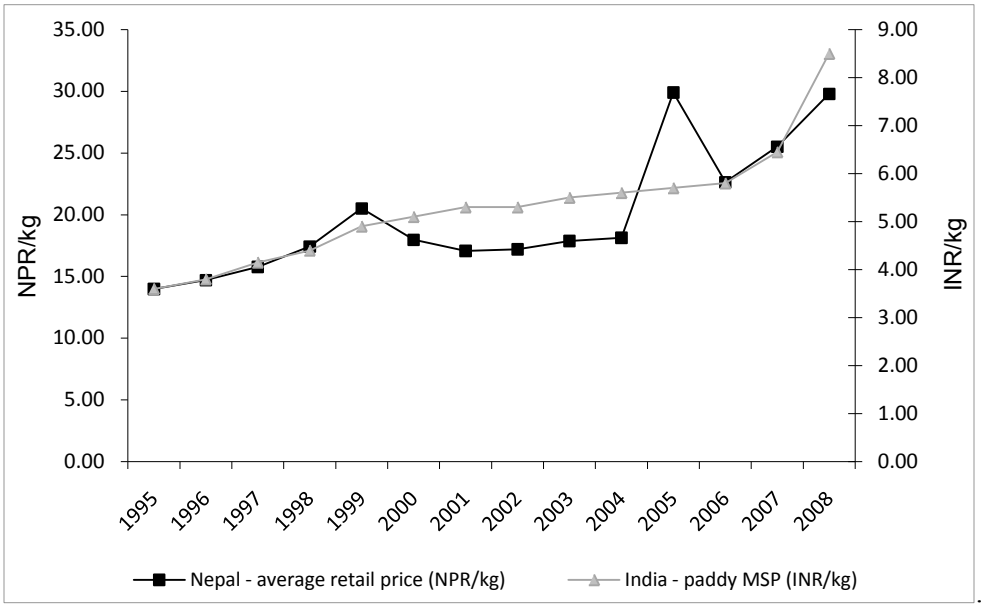
Discussions with officials in the Directorate of Marketing (DoM) under the MoAC revealed that none of the wholesale government market yards deal with grain sales; only perishable goods—fruits, vegetables, fishery products, and so on—are traded in these market yards. Though attempts were made in

[9] Weekly markets held at a village or a group of nearby villages.

the past to set up market yards exclusively for food grain trade, it appears that such yards have either shut down or morphed into vegetable and fruit market yards.

With the withdrawal of government procurement and the absence of any public procurement directly from farmers, there is not enough information on the farmgate prices that cereal farmers receive in Nepal. Considering the fact that sizable amounts of food grains spill over from the Indian side of the border into Nepalese markets (largely through informal channels), it would be important to understand how this impacts the prices received by farmers in Nepal. With food grain cultivators in India receiving various input subsidies, it is possible that the grain entering into Nepal from India might be sold at a lower price than domestically produced grain. In the absence of farm-level price data, as well as reliable estimates of the informal food-grain trade along the border, it becomes difficult to probe this aspect in greater detail. However, a comparison of the national average retail price for coarse rice in Nepal and the MSP of paddy (common) in India does show that the two prices follow a similar trend in their rise (Figure 4.2), indicating the existence of a relationship between the prevailing prices in India and the corresponding prices in Nepal.

Figure 4.2—National average retail price for coarse rice in Nepal and minimum support price (MSP) for paddy (common) in India



Source: Nepal, MoAC 2009 and RBI 2010.

Private-Sector Participation in Grain Markets

With the role of public interventions in the food grain market being minimal, as seen above, it comes as no surprise that private traders and millers are responsible for the majority of trade in food grains—both domestically produced and imported.

In the case of paddy, a 2006 survey of wholesalers across Nepal estimated that almost 70 percent of the rice is sourced by wholesalers from millers (WFP and FAO 2007). Local traders at the village level (called *kantawallahs*) serve as the link between farmers and these millers. Informal transit markets along the major trade networks within the country also serve an important role in providing the forward and backward linkages for trade between the Terai and the Hill and Mountain regions (IFPRI 2010). Currently, according to the Federation of Nepalese Chambers of Commerce and Industry (FNCCI), there are an estimated 430 grain mills in the private sector at various scales of operation in Nepal. However, it appears that the food grain trade is mainly controlled by a few large traders and millers (WFP and FAO

2007). The private sector is also a supplier of food grains, edible oils, pulses, and sugar to state trading agencies involved in public distribution and for institutional buyers such as the military, police, and so on.

One of the major initiatives in Nepal directed at increasing private participation in commercial agriculture and agroprocessing has been the Agro Enterprise Centre (AEC) promoted by USAID and FNCCI. The AEC was set up in 1991 to "expand and strengthen market oriented private sector driven agro enterprises in order to increase the value and volume of high-value products sold domestically and internationally" (AEC 2010). Its activities have been spread across areas such as support to agricultural marketing and processing (through feasibility studies, business plans, and so on), institutional and program support to commodity associations and groups, policy advocacy, and so on.

Cooperatives in agricultural marketing in Nepal have also been active to some extent, especially in fruits, vegetables, and dairy, and not so much in the cereal and food grain sector. The GoN passed a new Cooperative Act in 1992, following which the cooperative sector seems to have shown a substantial increase. The number of registered cooperatives grew from 830 in 1990 to 9,362 by 2007 (Nepal, MoAC 2007). This number includes nearly 1,500 dairy cooperatives and more than 1,100 agriculture cooperatives. The cooperative system in Nepal is organized around a three-tier structure. The primary cooperatives at the village level are federated into sector-specific cooperative unions at the district level, of which there are 72, and the district unions are in turn federated into five central cooperative unions (one each for dairy, coffee, fruits and vegetables, consumers, and savings and credit) (IFPRI 2010). The nodal representative agency at the national level is the National Cooperative Federation (NCF). According to the NCF, there are 1.2 million members in these cooperative organizations, with women forming nearly one-third of the total membership. The NCF also estimates the contribution of the cooperative sector to GDP to be around 1 percent (NCF Nepal 2007). However, in the absence of information on the revenue and funding sources of these cooperatives, it is difficult to determine whether these cooperatives are indeed able to function independently.

5. THE WAY FORWARD

The analysis of the performance of the agricultural sector in Nepal undertaken here indicates that although the overall GDPA growth has been on the positive side in recent years, there seems to be some amount of stagnation in the growth of key cereals—paddy, wheat, and maize. Except for maize, the production growth rates show a decline in this decade (2001 onward) compared to the previous decade. Paddy, which is by far the major crop in Nepal, as well as the main staple in the Nepalese diet, shows a decline in the growth rate of production from 2.9 percent in the 1990s to a 1.7 percent average annual growth rate post-2000/01. The overall cereal production growth rate also lags behind the population growth rate in Nepal. This is likely to exacerbate the cereal availability situation in the country and might have widespread impact on the food security status of households, especially in those regions of the country that suffer from poor infrastructural connectivity and a lack of market linkages. In addition, increased dependence on food imports would add to the burden on Nepal's foreign exchange reserves, which the country may not be in a position to afford. Considering these factors, it does seem that there is a pressing need to improve cereal productivity in Nepal.

From our examination of the status and utilization of various agricultural inputs, it is evident that availability and usage is at a very low level for most of the inputs in Nepal. The analysis also suggests various factors limiting the use of inputs for agriculture. These include factors related to the socioeconomic conditions of agricultural holdings in Nepal, supply bottlenecks, policy gaps, and institutional constraints. Some of these factors are fairly universal, affecting utilization across most of the input sectors as well as affecting output marketing. These include limited capital and limited access to affordable credit by farmers, and a lack of transport and power infrastructure, which impedes market supply and domestic manufacturing—especially in rural areas. There are other policy and institutional factors that are specific to each of the input sectors. Table 5.1 summarizes the gaps and constraints under each of the input sectors. The last column of Table 5.1 also outlines areas where there are possible opportunities for partnerships between the government and other stakeholders.[10]

Table 5.1—Gaps/constraints on the input side and potential areas of partnership/collaboration for the Cereals System Initiative South Asia (CSISA) in Nepal

Input Sector	Gaps/Constraints	Areas of Partnership/Collaboration
Seed sector	• Limited domestic research and development (R&D) capacity and resources • Inadequate breeder and foundation seed production facilities—both public and private— as well as seed multiplication facilities • Mechanisms for ensuring seed health and checking quality lack sufficient resources	• Varietal testing and improvement ongoing in CSISA • The International Rice Research Institute (IRRI) and the International Center for Maize and Wheat Improvement (CIMMYT)—long-standing collaborators with the Nepal Agricultural Research Council (NARC) and also with a few civil-society organizations • Possible partnerships in the future with private- and public-sector enterprises to build capacity for seed production and multiplication, especially in the Hill and Mountain regions

[10] We focus here on the opportunities under the CSISA project. It must be recognized that this partnership may not be able to overcome all the gaps and constraints identified here. But to the extent that the CSISA experience provides viable models for overcoming these constraints, it could contribute meaningfully to alleviating constraints affecting Nepali agriculture as a whole.

Table 5.1—Continued

Input Sector	Gaps/Constraints	Areas of Partnership/Collaboration
Fertilizer sector	• Complete dependence on imports—investing in domestic production capacity, however, may be economically unviable • Reintroduced government subsidy does not seem to be effective in its current form • Need to find effective alternatives or at least reduce the requirement for chemical fertilizers	• Best practices tested under CSISA for retaining nutrients and improving efficiency of inputs under conservation agriculture (CA) and disseminated through partners can help address this issue • Important to adapt these solutions to the conditions in the Hill and Mountain regions, where availability of and access to fertilizer is difficult
Irrigation sector	• Groundwater utilization is limited • Lack of year-round irrigation	• Moisture-retention practices and reduced irrigation requirements through zero tillage can help address the shortage of irrigation infrastructure to some extent • Exploring options for combining CA with pro-poor irrigation solutions / community-managed irrigation systems could be considered through partnering with agencies already working in these areas
Farm mechanization and agricultural equipment	• Limited domestic R&D and manufacturing capacity • Lack of clear, specific policies and guidelines • Stagnating local manufacturing • Need for low-cost alternatives and technology adapted to local conditions	• Proven technologies need to be adapted and innovated upon to ensure accessibility for the majority of farmers—partnering with local manufacturers and artisans to develop these solutions could hold potential • Collaborating with the concerned government agencies to develop guidelines and standards for this technology is also pertinent
Agricultural research and extension	• Limited domestic R&D capacity and resources • Resource crunch for public extension system	• CSISA activities and CSISA partner institutions have been involved in various activities aimed at building domestic research capacity and support, especially with the public sector • Partnering with private/civil-society research capability could help address future domestic needs • CSISA also provides opportunities to test various dissemination/extension models used by partners in order to develop an effective model for revitalizing the public extension system in Nepal
Agricultural credit	• Formal credit channels' reach is limited • Mushrooming of financial institutions in private NGO/cooperative sector whose reliability, effectiveness, and cost have yet to be established	• Here too the dissemination models under CSISA offer an opportunity to partner with reliable credit-provisioning institutions and to test and evaluate the efficacy of different routes and models to improve the credit flow to farmers

Source: Authors.

The output scenario in Nepal presents a challenge of its own. Public intervention in cereal markets does not seem feasible—the capacity in terms of infrastructure and other resources for public agencies to intervene directly in procurement is very limited, and so is the feasibility of regulating output prices. Here the optimal way forward for the government would be to focus on investments aimed at expanding and improving basic infrastructure—roads, power, communications, and so on.

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